



Secondary metabolites from the aerial parts of *Centaurea papposa* (Coss.) Greuter



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ABSTRACT

The aerial parts of *Centaurea papposa*, a species growing wild in Algeria and Tunisia, were investigated for the occurrence of sesquiterpene lactones. The germacranolide cnicin is the main compound. In addition one eudesmanolide, two elemanolides, one elemene derivative and the flavonoid eupatorin were isolated.

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1. Introduction

The genus *Centaurea* L. (Asteraceae, Carduae) comprises about 500 species and its distribution is mainly in Europe and Asia (Mabberley, 1997). The genus is characterized by its ability to biosynthesize sesquiterpene lactones (Seaman, 1982) and flavonoids (Formisano et al., 2012), which are important chemotaxonomic markers. In addition, they exhibit high activity in living systems, thus have a strong pharmacological interest, as well as explaining the long-term use of the genus in folk medicine (Khammar and Djeddi, 2012; Boulos, 1983; Perrot and Paris, 1971). *C. papposa* is a species growing wild in Algeria and Tunisia (Quezel and Santa, 1963), belonging to the *Centaurea* section, subsection *Acrolophus* (Cass.) DC. (Hilpold et al., 2011). Many previous chemical studies have been recorded on species belonging to the same section and subsection (Tables 1 and 2).

2. Materials and methods

2.1. Plant material

The aerial parts of the plant were collected at “Cape de Garde” Lighthouse at the northwest of the port of Annaba city (Algeria) on September 2016; altitude 58 m; Coordinates (WGS84): 36°57'28"N; 007°46'10"E. The plant was identified by Dr. Hamel Tarek and voucher specimens were deposited to the Herbarium of Department of Biology, University Badji Mokhtar Annaba, Algeria, under the name Djeddi & Skaltsa BV 01/2017.

2.2. Isolation and identification of the compounds from *C. papposa*

The air-dried and finely ground aerial parts of the plant (0.5 kg) were extracted at room temperature with cyclohexane:Et₂O:MeOH (1:1:1) and the isolation of the secondary metabolites was carried out according to the Bohlmann method (Bohlmann et al., 1984), slightly modified. The extract was washed with brine and the aqueous layer re-extracted with EtOAc. The residue (1.26 g) was pre-fractionated by VLC on silica gel using DM-EtOAc-MeOH mixtures of increasing polarity as eluents to give several fractions (A–I). The fractions D (57.2 mg; eluted with cHex-EtOAc 25:75) and E (149.9 mg; eluted with EtOAc 100%) subjected to CC over silica gel using DM:EtOAc:MeOH mixtures, yielded eupatorin (**6**; 22.7 mg,

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Table 1
Sesquiterpene lactones isolated from *Centaurea* L. species, belonging to section *Centaurea*, subsections *Acrolophus* (Cass.) DC., *Phalolepis* (Cass.) and *Willkommia* (Blanca). A: *Acrolophus* P: *Phalolepis* W: *Willkommia*.

<i>Centaurea</i> species*	Sub-section	Sesquiterpene lactones	Literature
<i>C. affinis</i> Friv.	A	Cnicin, salonitenolide	Janacković et al., 2004
<i>C. affinis</i> subsp. <i>pallidior</i> (Halácsy) Hayek (= <i>C. pallidior</i> Halácsy subsp. <i>pallidior</i>)	A	Cnicin	Nowak et al., 1984
<i>C. aggregata</i> Fisch. & C.A.Mey. ex DC.	A	Cnicin	Nowak et al., 1984
<i>C. alba</i> L.	P	Cnicin, cnicin 4'- <i>O</i> -acetate, salonitenolide, 11 β ,13-dihydrosalonitenolide, salonitenolide 8 α - <i>O</i> -(4-acetoxy-5-hydroxy)-angelate	Fernandez et al., 1995
<i>C. aplolepa</i> Moretti (= <i>C. aplolepa</i> subsp. <i>aplolepa</i>)	A	Cnicin	Nowak et al., 1984
<i>C. aplolepa</i> Moretti subsp. <i>lunensis</i> (Fiori) Dostál	A	Cnicin	Nowak et al., 1984
<i>C. arenaria</i> M.Bieb. ex Willd. (= <i>C. arenaria</i> Bieb. Aex Willd. subsp. <i>arenaria</i>)	A	Cnicin Cnicin	Nowak et al., 1984 Csapi et al., 2010
<i>C. attica</i> Nyman (= <i>C. attica</i> Nyman subsp. <i>attica</i>)	A	Cnicin, cnicin 4'- <i>O</i> -acetate, 8 α - <i>O</i> -(3,4-dihydroxy-2-methylenebutanoyloxy)-dehydromelitensin, methyl 8 α - <i>O</i> -(3,4-dihydroxy-2-methylenebutanoyloxy)-6 α ,15-dihydroxyelema-1,3,11(13)-trien-12-oate	Skaltsa et al., 1999
		Malacitanolide, atticin, 8 α - <i>O</i> -(4-acetoxy-3-hydroxy-2-methylenebutanoyloxy)-4-epi-sonchucarpolide	Skaltsa et al., 2000
<i>C. bombycina</i> Boiss. ex DC.	W	Cnicin, salonitenolide, 8 α - <i>O</i> -(4-acetoxy-5-hydroxyangelate)-salonitenolide	Barrero et al., 2000
<i>C. bovina</i> Velen (= <i>C. diffusa</i> Lam. var. <i>brevispina</i> Boiss.)	A	Cnicin	Nowak et al., 1984
<i>C. busambarensis</i> Guss. (= <i>C. cineraria</i> subsp. <i>busambarensis</i> (Guss.) Dostál)	A	Cnicin, dehydromelitensin, 8 α - <i>O</i> -(3,4-dihydroxy-2-methylenebutanoyloxy)-dehydromelitensin	Bruno et al., 1998
<i>C. cadmea</i> Boiss.	P	2 α -hydroxy-5 α H-eudesman-4(15),11(13)-dien-12,8 β -olide (ivalin)	Karamenderes et al., 2007
<i>C. caliacrae</i> Prodan [= <i>C. alba</i> subsp. <i>caliacrae</i> (Prodan) Dostál]	P	Salonitenolide	Geppert et al., 1983
<i>C. calolepis</i> Boiss.	A	Cnicin	Erel et al., 2011
<i>C. castellana</i> Boiss. [= <i>C. paniculata</i> subsp. <i>castellana</i> (Boiss. & Reut.) Dostál]	A	Artemissifolin, Dehydromelitensin, 11 β ,15-dihydroxyssaussurea lactone	Gonzalez et al., 1984
<i>C. cineraria</i> L. (= <i>C. cineraria</i> subsp. <i>cineraria</i>)	A	Cnicin	Nowak et al., 1984
<i>C. cineraria</i> subsp. <i>circae</i> (Sommier) Cela Renz. & Viegi	A	Cnicin	Nowak et al., 1984
<i>C. crithmifolia</i> Vis.	A	Salonitenolide	Geppert et al., 1983
<i>C. cuneifolia</i> Sibth. & SM. (= <i>C. cuneifolia</i> subsp. <i>cuneifolia</i>)	A	Cnicin, dehydromelitensin, 8 α - <i>O</i> -(3,4-dihydroxy-2-methylenebutanoyloxy)-dehydromelitensin	Aslan and Öksüz, 1999
<i>C. cuneifolia</i> Sibth. & SM. subsp. <i>pallida</i> (Friv.) Hayek	A	Cnicin	Nowak et al., 1984
<i>C. derventana</i> Vis. & Pancić	A	Cnicin, cnicin-4'- <i>O</i> -acetate, salonitenolide, 8 α - <i>O</i> -(4-acetoxy-5-hydroxyangelate) salonitenolide	Tešević et al., 1998
<i>C. deusta</i> Ten.	P	Salonitenolide Cnicin, cnicin-4'- <i>O</i> -acetate, cnicin-3'-acetate 8 α - <i>O</i> -(3,4-dihydroxy-2-methylenebutanoyloxy)-dehydromelitensin, 8 α - <i>O</i> -(4-acetoxy-3-hydroxy-2-methylenebutanoyloxy)	Geppert et al., 1983 Karioti et al., 2002

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